

### What is claimed is:

1. A method of radiotherapy of a malignant neoplasm with the usage of X-ray beams includes two stages: in the first stage an image of the internal structure of a part of a patient's body (5) is formed, including a malignant neoplasm, with the organs and tissues, surrounding it, on the basis of data as a set of space coordinates of the points, the current results of measuring are referred to, and the values of a density of biological tissues of the patient's body, corresponding to the said coordinates,

the images of the structural elements, relating to the malignant neoplasm, are identified with the usage of the results of the preceding diagnostics,

an irradiation program is formed as a set of X-ray doses, which should be delivered to different parts of the malignant neoplasm, represented by fixed sets of the point coordinates,

then the second stage begins, when formed irradiation program is carried out, wherein in the first stage to obtain the said data about the internal structure of the patient's body an X-rays is concentrated in the zone (16) with the point, the current results of measuring are referred to, placed inside the part of the patient's body, including the malignant neoplasm,

a secondary radiation, emerging in the said zone, is transported to one or more detectors (6, 20),

the part of the patient's body, including the malignant neoplasm, is scanned by mutual moving the zone of a radiation concentrating and the patient's body,

on the basis of intensity values of the secondary radiation, obtained by means of one or more detectors and defined simultaneously with the coordinates of the point of the zone of X-rays concentrating, the current results of measuring are referred to, a density of the biological tissues in the said point is defined,

the quantitative coefficients, taken as the values of a density of the biological tissues, with the values of coordinates, corresponding to the said coefficients, are used for forming the images of a density distribution of the biological tissues in the part of the patient's body, including the malignant neoplasm,

in the second stage an area, occupied by the malignant neoplasm, is scanned, simultaneously concentrating an X-rays by means of the same means as in the first stage, so that the positions, occupied by the concentrating zone (16), correspond to the parts of the malignant neoplasm, represented by the sets of the point coordinates, fixed in the first stage as a result of the images of the structural elements identifying, related to the malignant neoplasm,

the irradiation program, formed in the first stage, is carried out by increasing an intensity of an X-rays as compared with the first stage and controlling an irradiation time.

2. A method according to claim 1, wherein an X-rays concentrating in the zone (16) with the point, the current results of measuring are referred to, placed inside the part of the patient's body, including the malignant neoplasm, is realized by means of one or more collimators (13, 18), using the corresponding quantity of spaced X-ray sources (1, 17),

transporting an emerging secondary radiation to one or more detectors is realized by means of one or more collimators (15, 19),

thus all collimators are oriented so that the axes of their central channels cross in the point, the current results of measuring are referred to.

3. A method according to claim 1, wherein an X-rays concentrating in the zone (16) with the point, the current results of measuring are referred to, placed inside the part of the patient's body, including the malignant neoplasm, is realized by means of one or more X-ray half lenses (21), which transform a divergent radiation of corresponding quantity of spaced X-ray sources (1) to a quasi-parallel one,

transporting an emerging secondary radiation to one or more detectors is realized by means of one or more X-ray half lenses (22, 23), which focus this radiation on the detectors (6, 20) or form a quasi-parallel radiation,

thus all X-ray half lenses are oriented so that their optical axes cross in the point, the current results of measuring are referred to.

4. A method according to claim 1, wherein an X-rays concentrating in the zone (16) with the point, the current results of measuring are referred to, placed inside the part of the patient's body, including the malignant neoplasm, is realized by means of one or more X-ray half lenses (21), which transform a divergent radiation of corresponding quantity of spaced X-ray sources (1) to a quasi-parallel one,

transporting an emerging secondary radiation to one or more detectors is realized by means of one or more X-ray lenses (3), which focus this radiation on the detectors (6),

thus all X-ray half lenses and lenses are oriented so that their optical axes cross in the point, the current results of measuring are referred to.

5. A method according to claim 1, wherein an X-rays concentrating in the zone (16) with the point, the current results of measuring are referred to, placed inside the part of the patient's body, including the malignant neoplasm, is realized by means of several X-ray half lenses (21), which transform a divergent radiation of corresponding quantity of spaced sources to a quasi-parallel one,

transporting an emerging secondary radiation to one or more detectors is realized by means of one or more collimators (19, 15),

thus all X-ray half lenses and collimators are oriented so that the optical axes of all X-ray half lenses and the central channels of all collimators cross in the point, the current results of measuring are referred to.

6. A method according to claim 1, wherein an X-rays concentrating in the zone (4) with the point, the current results of measuring are referred to, placed inside the part of the patient's body, including the malignant neoplasm, is realized by usage of one or more spaced X-ray sources (1) and corresponding quantity of X-ray lenses (3), which focus a divergent X-rays of each source in the point, the current results of measuring are referred to,

transporting an emerging secondary radiation to one or more detectors (6) is realized by means of X-ray lenses (3), which focus this radiation on the detectors and have the second focus in the said point.

7. A method according to claim 1, wherein an X-rays concentrating in the zone (16) with the point, the current results of measuring are referred to, placed inside the part of the patient's body, including the malignant neoplasm, is realized by using one or more spaced X-ray sources (1) and corresponding quantity of X-ray lenses (2), which focus a divergent X-rays of each source in the point, the current results of measuring are referred to,

2024-02-20 10:00:00

8. A method of determining a location of a malignant neoplasm with the usage of X-ray beams, where an image of the internal structure of the part of the patient's body, including the malignant neoplasm and the organs and tissues, surrounding the said neoplasm, is formed on the basis of the information as a set of space coordinates of the points, the current results of measuring are referred to, and the values of density of the biological tissues, corresponding to that coordinates,

a secondary radiation, emerging in the said zone, is transported to one or more detectors.

on the basis of the set of values of the secondary radiation, obtained by means of one or more detectors and defined simultaneously with the coordinates of the point of the zone of X-rays concentrating, the current results of measuring are referred to, a density of the biological tissues in this point is defined,

then the combinations of the coordinates of the points and the densities of the biological tissues, corresponding to the said points, identified as referred to the malignant neoplasm, are fixed.

transporting an emerging secondary radiation to one or more detectors is realized as well by means of one or more collimators (15, 19).

10. A method according to claim 8, wherein an X-rays concentrating in the zone (16) with the point, the current results of measuring are referred to, placed inside the part of the patient's body, including the malignant neoplasm, is realized by means of one or more X-ray half lenses (21), which transform a divergent radiation of corresponding quantity of spaced X-ray sources to a quasi-parallel one,

transporting an emerging secondary radiation to one or more detectors is realized by means of one or more X-ray half lenses (22), which focus this radiation on the detectors (6, 20) or form a quasi-parallel radiation.

thus all X-ray half lenses are oriented so that their optical axes cross in the point, the current results of measuring are referred to.

11. A method according to claim 8, wherein an X-rays concentrating in the zone (16) with the point, the current results of measuring are referred to, placed inside the part of the patient's body (5), including the malignant neoplasm, is realized by means of one or more X-ray half lenses (21), which transform a divergent radiation of corresponding quantity of spaced X-ray sources (1) to a quasi-parallel one,

transporting an emerging secondary radiation to one or more detectors (6) is realized by means of one or more X-ray lenses (22), which focus this radiation on the detectors,

thus all X-ray half lenses and lenses are oriented so that their optical axes cross in the point, the current results of measuring are referred to.

12. A method according to claim 8, wherein an X-rays concentrating in the zone (16) with the point, the current results of measuring are referred to, placed inside the patient's body, including the malignant neoplasm, is realized by means of several X-ray half lenses (21), which transform a divergent radiation of corresponding quantity of spaced sources (1) to a quasi-parallel one,

transporting an emerging secondary radiation to one or more detectors (6, 20) is realized by means of one or more collimators (15, 19),

thus the X-ray half lenses and collimators are oriented so that the optical axes of all X-ray half lenses and the central channels of all collimators cross in the point, the current results of measuring are referred to.

13. A method according to claim 8, wherein an X-rays concentrating in the zone with the point, the current results of measuring are referred to, placed inside the part of the patient's body, including the malignant neoplasm, is realized by usage of one ore more spaced X-ray sources (1) and corresponding quantity of X-ray lenses (2), which focus a divergent X-rays of each source in the point (4), the current results of measuring are referred to,

transporting an emerging secondary radiation to one or more detectors (6) is realized by means of the X-ray lenses (3), which focus this radiation on the detectors and have the second focus in the said point.

14. A method according to claim 8, wherein an X-rays concentrating in the zone with the point, the current results of measuring are referred to, placed inside the part of the patient's body, including the malignant neoplasm, is realized by usage of one or more spaced X-ray sources (1) and corresponding quantity of X-ray lenses (2), which focus a divergent radiation of each source in the point, the current results of measuring are referred to,

transporting an emerging secondary radiation to one or more detectors (6, 20) is realized by means of the collimators (15, 19), oriented so that the optical axes of their central channels cross in the said point.

15. A device for determining a location of a malignant neoplasm and its radiotherapy with the usage of X-ray beams, comprising an X-ray optical system (8), a device (10) for the patient's body and the X-ray optical system relative positioning, a device (12) for data processing and imaging, thus the X-ray optical system (8) includes one or more X-ray sources (1) with the devices (2) for their radiation

20240308-034001

concentrating and one or more detectors (6), which outputs are connected up to the device (12) for data processing and imaging, wherein the X-ray sources, being a part of the X-ray optical system (8), are made with a possibility of changing the intensity of their radiation,

the X-ray optical system comprises a means (9) of joint controlling by the radiation intensity of X-ray sources (1),

the means (2) for concentrating the radiation of these sources are made and placed with a possibility of concentrating the radiation of all sources in the zone with the point, the current results of measuring are referred to, placed inside the part of the patient's body (5), including the malignant neoplasm,

the X-ray optical system (8) comprises as well one or more means (3) for transporting a secondary radiation, emerging in the concentration zone, to the detectors (6), placed at the outputs of the said means and made sensitive to the said secondary radiation,

the sensors (11), connected with the means (10) of the patient's body and the X-ray optical system relative positioning, for determining the coordinates of the point, the current results of measuring are referred to, placed inside the part of the patient's body (5), including the malignant neoplasm, are connected with their outputs up to the means (12) for data processing and imaging,

the said means is made with a possibility of forming and imaging a density distribution of the tissues, resulting from scanning by the area of concentrating a radiation of the X-ray sources the part of the patient's body (5), including the malignant neoplasm, by means of the means (10) for the patient's body and the X-ray optical system relative positioning.

16. A device according to claim 15, wherein an X-ray optical system comprises several X-ray sources (1, 17),

each means for concentrating the radiation of the said sources in the zone (16) with the point, the current results of measuring are referred to, and each means for transporting a secondary radiation, emerging in the said zone, to the detectors (6, 20) are made as the collimators (13, 15, 18, 19) with the channels, oriented to the zone of concentrating a radiation of the X-ray sources,

thus the optical axes of the central channels of all collimators cross in the point, the current results of measuring are referred to.

17. A device according to claim 16, wherein the X-ray sources (1), being a part of the X-ray optical system, are quasi-pointed,

the collimators (13) have the channels, focused on the said sources,

a screen (14) with a hole is placed between the output of each X-ray source and the input of corresponding collimator.

18. A device according to claim 16, wherein the X-ray sources (17), being a part of the X-ray optical system, are extended,

the collimators (18) have the channels, widening toward the X-ray sources.

19. A device according to claim 15, wherein the X-ray sources (1), being a part of the X-ray optical system, are quasi-pointed,

each means for an X-rays concentrating in the zone with the point, the current results of measuring are referred to, is made as an X-ray half lens (21), which transforms a divergent radiation of the corresponding source to a quasi-parallel one,

each means for transporting an emerging secondary radiation to the detector is made as an X-ray half lens (22), focusing this radiation on the detector (6),

thus the optical axes of all X-ray half lenses cross in the point, the current results of measuring are referred to.

20. A device according to claim 15, wherein the X-ray sources (1), being a part of the X-ray optical system, are quasi-pointed,

each means for X-rays concentrating in the zone with the point, the current results of measuring are referred to, is made as an X-ray half lens (21), which transforms a divergent radiation of the corresponding source to a quasi-parallel one,

each means for transporting an emerging secondary radiation to the detector (20) is made as an X-ray half lens (23), which forms a quasi-parallel radiation and has a focus in the zone (16) of an X-rays concentrating,

thus the optical axes of all X-ray half lenses cross in the point, the current results of measuring are referred to.

21. A device according to claim 15, wherein the X-ray sources (1), being a part of the X-ray optical system, are quasi-pointed,

each means for X-rays concentrating in the zone (16) with the point, the current results of measuring are referred to, is made as an X-ray half lens (21), which transforms a divergent radiation of the corresponding source to a quasi-parallel one,

each means for transporting an emerging secondary radiation to the detector (20) is made as an X-ray lens (3), which focuses this radiation on the detector (6) and has the second focus in the zone of an X-rays concentrating,

the optical axes of all X-ray half lenses and lenses cross in the point, the current results of measuring are referred to.

22. A device according to claim 15, wherein the X-ray sources (1), being a part of the X-ray optical system, are quasi-pointed,

each means for an X-rays concentrating in the zone with the point, the current results of measuring are referred to, is made as an X-ray half lens (21), which transforms a divergent radiation of the corresponding source to a quasi-parallel one,

each means for transporting an emerging secondary radiation to the detector is made as a collimator (19) with the channels, diverging toward the corresponding detector (20),

the optical axes of all X-ray lenses and half lenses and the central channels of the collimators cross in the point, the current results of measuring are referred to.

23. A device according to claim 15, wherein the X-ray sources (1), being a part of the X-ray optical system, are quasi-pointed,

each means for an X-rays concentrating in the zone (16) with the point, the current results of measuring are referred to, is made as an X-ray half lens (21), which transforms a divergent radiation of the corresponding X-ray source to a quasi-parallel one,

each means for transporting an emerging secondary radiation to the detector is made as a collimator (15) with the channels, converging toward the corresponding detector (6),

the optical axes of all X-ray half lenses and the central channels of the collimators cross in the point, the current results of measuring are referred to.

24. A device according to claim 15, wherein the X-ray sources (1), being a part of the X-ray optical system, are quasi-pointed,

each means for an X-rays concentrating in the zone with the point, the current results of measuring are referred to, is made as an X-ray lens (2), which focuses a divergent radiation of an X-ray source,

each means for transporting an emerging secondary radiation to the detector is made as an X-ray lens (3), which focuses this radiation on the corresponding detector (6),

the optical axes of all X-ray lenses cross in the point (4) the current results of measuring are referred to.

25. A device according to claim 15, wherein the X-ray sources (1) being a part of the X-ray optical system are quasi-pointed,

each means for an X-rays concentrating in the zone with the point, the current results of measuring are referred to, is made as an X-ray lens (2), which focuses a divergent radiation of an X-ray source,

each means for transporting an emerging secondary radiation to the detector is made as a collimator (15) with the channels, converging toward the corresponding detector (6),

the optical axes of all X-ray lenses and the central channels of the collimators cross in the point, the current results of measuring are referred to.

26. A device according to claim 15, wherein the X-ray sources (1) being a part of the X-ray optical system are quasi-pointed,

each means for an X-rays concentrating in the zone (16) with the point, the current results of measuring are referred to, is made as an X-ray lens (2), which focuses a divergent radiation of an X-ray source,

each means for transporting an emerging secondary radiation to the detector is made as a collimator (19) with the channels, diverging toward the corresponding detector (20),

the optical axes of all X-ray lenses and the central channels of the collimators cross in the point, the current results of measuring are referred to.

27. A device according to any one of claims 15-26, wherein the said device comprises additionally the means for switching off or screening the detectors for the time of the X-ray sources operation with the increased intensity.

10049306-00054001